

## CLAIMS

We claim:

1           1. A semiconductor structure, comprising:  
2           a first substrate;  
3           a second substrate joined to the first substrate;  
4           a plurality of contacts between the first substrate and  
5 the second substrate; and  
6           a plurality of first solder bumps connected between the  
7 first substrate and the second substrate for aligning the  
contacts.

1           2. The semiconductor structure according to claim 1,  
2 wherein the contacts have a different composition than the  
first solder bumps.

1           3. The semiconductor structure according to claim 1,  
2 wherein at least one of the first substrate and the second  
substrate is an integrated circuit chip.

1           4. The semiconductor structure according to claim 1,  
wherein the contacts comprise second solder bumps.



wherein the contacts each have a diameter of about 10  $\mu\text{m}$ .

1           12. The semiconductor structure according to claim 1,  
2 wherein the contacts each have a diameter of less than about  
10  $\mu\text{m}$ .

1           13. The semiconductor structure according to claim 1,  
wherein the contacts have a pitch of less than about 100  $\mu\text{m}$ .

1           14. The semiconductor structure according to claim 1,  
wherein the contacts have a pitch of about 30  $\mu\text{m}$ .

1           15. The semiconductor structure according to claim 1,  
2 wherein the contacts have a diameter about 20% of the  
diameter of the first solder bumps.

1           16. The semiconductor structure according to claim 1,  
2 wherein the contacts comprise a material having a higher  
melting point than the first solder bumps.

1           17. The semiconductor structure according to claim 1,  
2 wherein an upper surface of the contacts and an upper  
surface of the first solder bumps are co-planar.



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1           24. The semiconductor structure according to claim 1,  
2 wherein the contacts comprise an optical transmitter and an  
optical receiver.

1           25. The semiconductor structure according to claim 1,  
2 wherein at least one of the first substrate and the second  
3 substrate is an integrated circuit chip, and the contacts  
4 are sufficiently small to permit alignment of individual  
devices on the integrated circuit chips.

1           26. A method of fabricating a semiconductor structure,  
2 the method comprising:

3           providing a first substrate and a second substrate;  
4           providing contacts on one of the first substrate and  
5 the second substrate;  
6           providing first solder bumps on one of the first  
7 substrate and the second substrate;  
8           mounting the first substrate on the second substrate;  
9 and  
10          reflowing the first solder bumps for surface tension  
aligning of the contacts.

1           27. The method according to claim 26, wherein the  
2 contacts have a different composition than the first solder

bumps.

1           28. The method according to claim 26, wherein at least  
2 one of the first substrate and the second substrate is an  
integrated circuit chip.

1           29. The method according to claim 26, wherein the  
contacts comprise second solder bumps.

1           30. The method according to claim 29, further  
2 comprising:

3           reflowing the second solder bumps, wherein the second  
4 solder bumps ball up to make contact between the first  
substrate and the second substrate.

1           31. The method according to claim 29, wherein the  
2 second solder bumps comprise a material having a higher  
3 melting point than the first solder bumps, and reflowing the  
4 second solder bumps requires heating the second solder bumps  
5 to a higher temperature than reflowing the first solder  
bumps.

1           32. The method according to claim 29, wherein the  
2 second solder bumps are provided with a smaller size than

the first solder bumps.

1           33. The method according to claim 26, wherein the  
contacts comprise electrically conductive epoxy.

1           34. The method according to claim 26, wherein the  
contacts comprise a polymer-metal composite.

1           35. The method according to claim 26, wherein  
2 reflowing the first solder bumps draws the first substrate  
3 toward the second substrate to cause the contacts to make  
contact with the first substrate and the second substrate.

1           36. The method according to claim 26, wherein the  
2 first solder bumps contact the first substrate and the  
3 second substrate prior to the contacts making contact  
between the first substrate and the second substrate.

1           37. The method according to claim 26, wherein the  
contacts are provided by thin film processing.

1           38. The method according to claim 37, wherein the thin  
2 film processing comprises lift off stencil or subtractive  
etch.

1           39. The method according to claim 26, wherein the  
2 contacts each are provided with a diameter of less than  
about 50  $\mu\text{m}$ .

1           40. The method according to claim 26, wherein the  
contacts each are provided with a diameter of about 10  $\mu\text{m}$ .

1           41. The method according to claim 26, wherein the  
2 contacts each are provided with a diameter of less than  
about 10  $\mu\text{m}$ .

1           42. The method according to claim 26, wherein the  
2 contacts are provided with a pitch of less than about 100  
 $\mu\text{m}$ .

1           43. The method according to claim 26, wherein the  
contacts are provided with a pitch of about 30  $\mu\text{m}$ .

1           44. The method according to claim 26, wherein the  
2 contacts are provided with a diameter about 20 % of the  
diameter of the first solder bumps.

1           45. The method according to claim 26, wherein the  
2 contacts are provided with a smaller size than the first



solder bumps.

1           46. The method according to claim 26, wherein the  
2 contacts provide optical communication between the first  
substrate and the second substrate.

1           47. The method according to claim 26, wherein the  
contacts comprise a waveguide.

1           48. The method according to claim 26, wherein the  
2 contacts comprise an optical transmitter and an optical  
receiver.

1           49. The method according to claim 26, wherein the  
2 contacts comprise at least one member selected from the  
3 group consisting of dendrites and self-interlocking micro  
connectors.

1           50. The method according to claim 26, wherein the  
2 contacts and the first solder bumps are provided such that  
3 an upper surface of the contacts and an upper surface of the  
first solder bumps are co-planar.

1           51. The method according to claim 26, wherein the

